The epidemiology of *Giardia* spp. infection among pet dogs in the United States indicates space-time clusters in Colorado

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Outline

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- ✓ Objectives
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- ✓ Results:
  - Prevalence
  - Space - time cluster analysis
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Introduction

- ***Giardia*** **spp. are enteric parasites that infect a wide range of hosts including humans and animals**
- **Only *G. duodenalis* (*G. lamblia, G. intestinalis*) have been recovered from human and animal species**
- ***G. duodenalis*** **is the most common intestinal parasite identified by public health laboratories in human fecal specimens in the United States**
- **Epidemiologic and molecular evidence suggest that some *Giardia* spp. are zoonotic**

Giardia spp. infection in dogs

- **Prevalence of *Giardia* spp. in dogs in North America ranges from 0.62% to 100%**
- **Most previous studies of Giardia in dogs have been limited to select population and relatively small geographic regions**
- **Prevalence of *Giardia spp.* in pet dogs visiting primary care veterinary hospitals has not been well characterized**

Objectives

- **Estimate *Giardia* spp. prevalence in pet dogs visiting a representative sample of primary care veterinary hospitals in the United States**
- **Identify high prevalence areas of *Giardia* spp. infection**
- **Characterize the spatial distribution and clustering of *Giardia* spp. infection in a high prevalence state**

Materials and methods

- **Retrieved the electronic medical records of dogs examined at Banfield® veterinary hospitals from January 2003 to December 2006**

- **Fields abstracted:**
  - ✓ **Unique ID for each dog**
  - ✓ ***Giardia* spp. fecal floatation test results (positive or negative)**
  - ✓ **Age, Gender and neuter status, Breed, date of the office visit**
  - ✓ **Latitude and longitude of owner's residence**

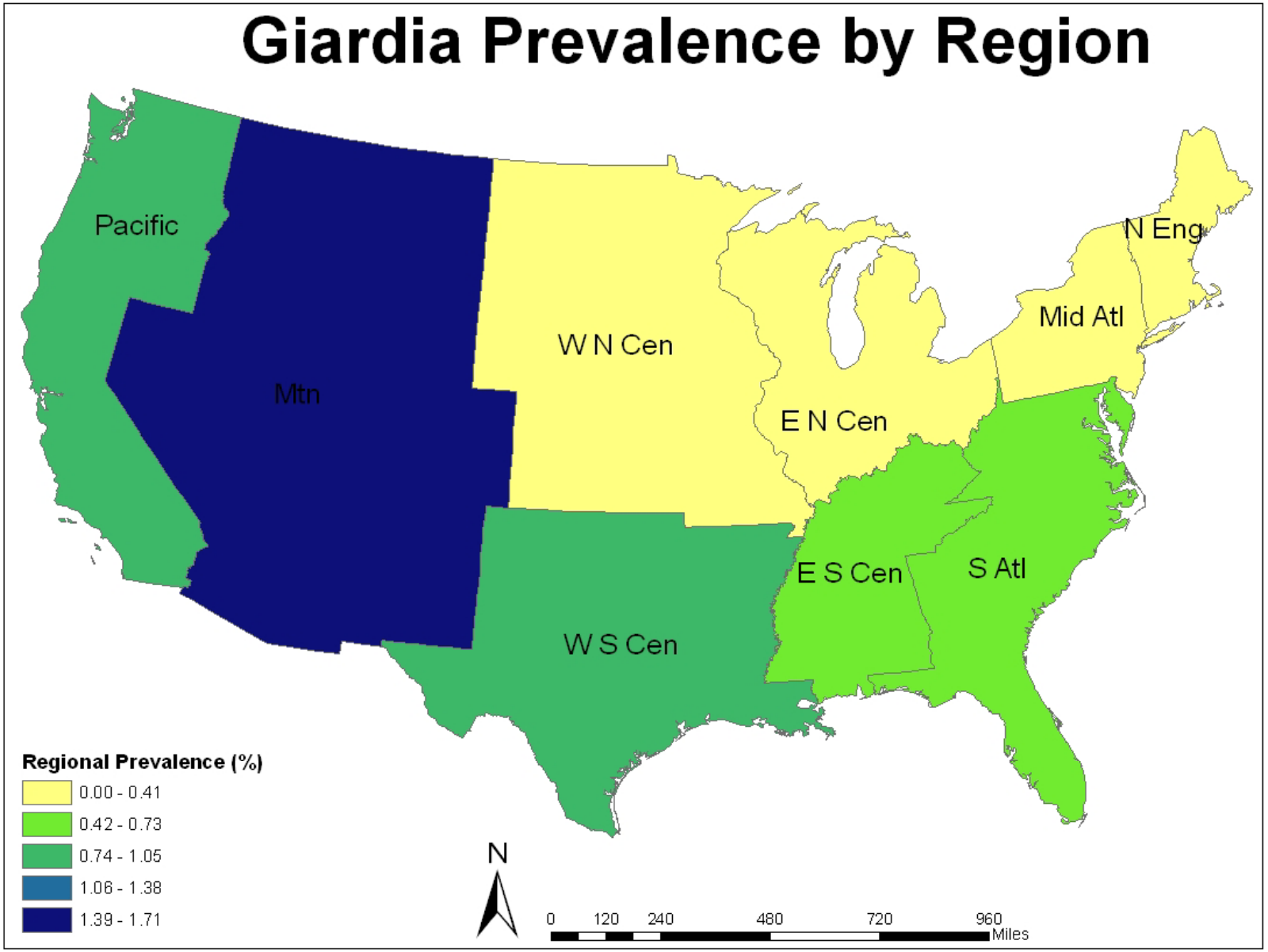
Material and methods

- **Prevalence calculated as percentage of fecal samples testing positive for *Giardia spp.* by flotation method**
- **Only used the first fecal test result for each dog to calculate prevalence and 95% confidence interval (CI)**
- **Stata 9.2 (StataCorp) for data analysis**
- **ArcMap 9.2 (ESRI) to map *Giardia* spp. prevalence**
- **SatScan 7.2 (Kulldorff M. and Information Management Services, Inc.) software to perform spatial and temporal cluster analysis**

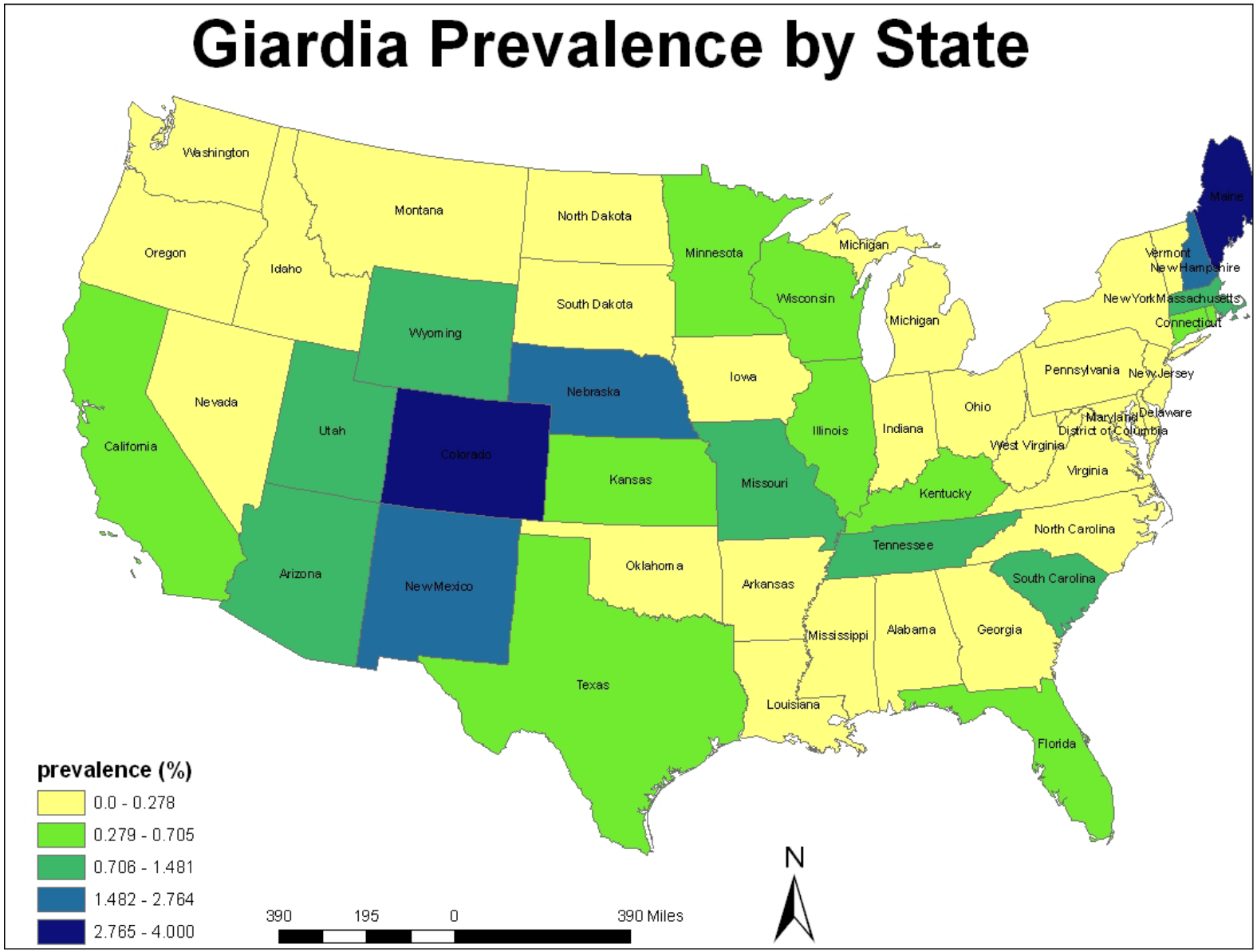
Results

Category	No. tested	Prevalence	Highest prev. group	Lowest prev. group
Overall	1,201,471	0.55 %	N/A	N/A
Age			<0.5 yrs 0.78 %	>5 yrs 0.33 %
Gender			Intact male 0.62 %	Sp. female 0.48 %
Breed			Working 0.65 %	Mixed 0.50 %
Region			Mountain 1.70 %	Mid Atlantic 0.10 %
Month of office visit			January 0.65 %	March 0.48 %

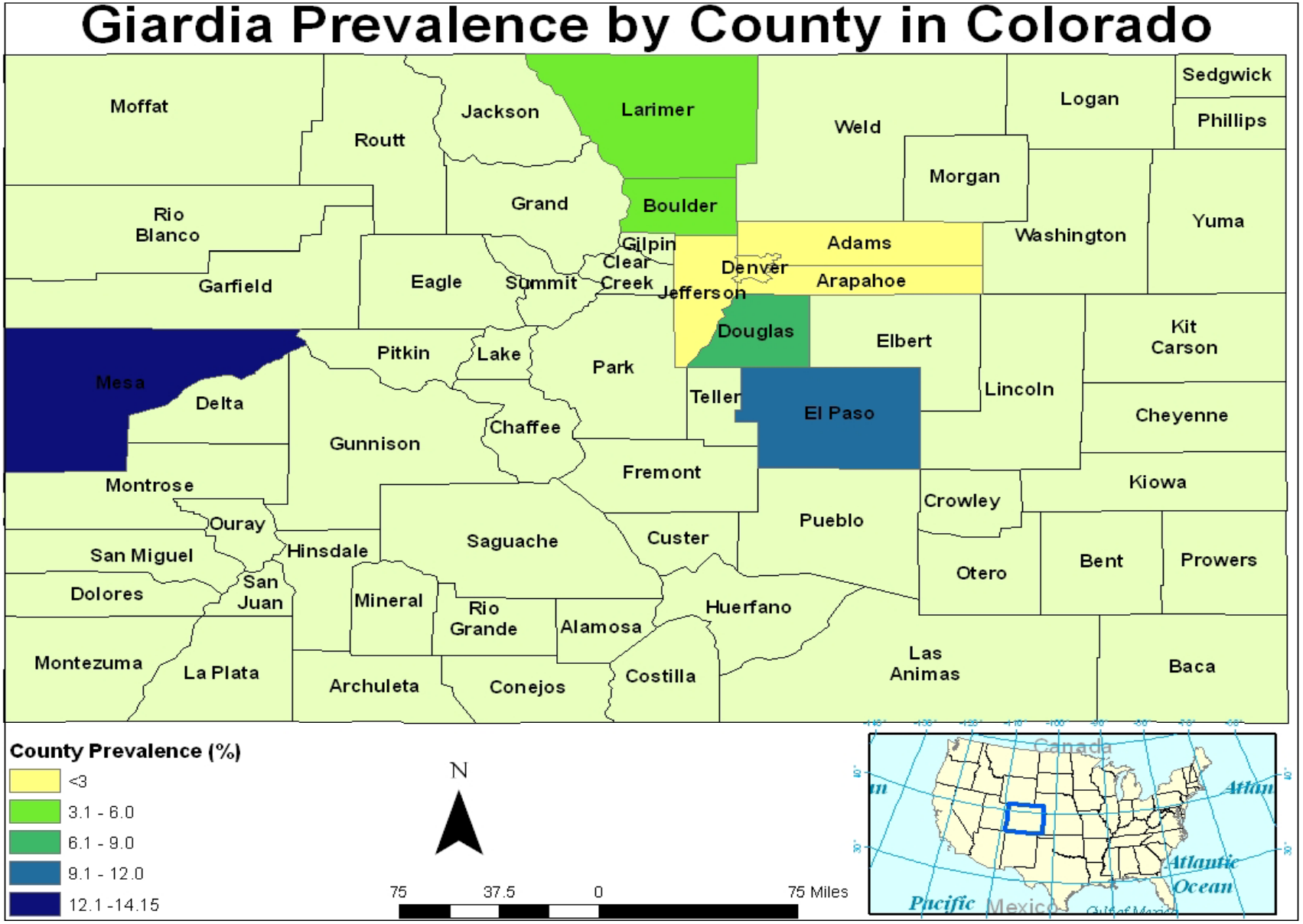
Giardia Prevalence by Region



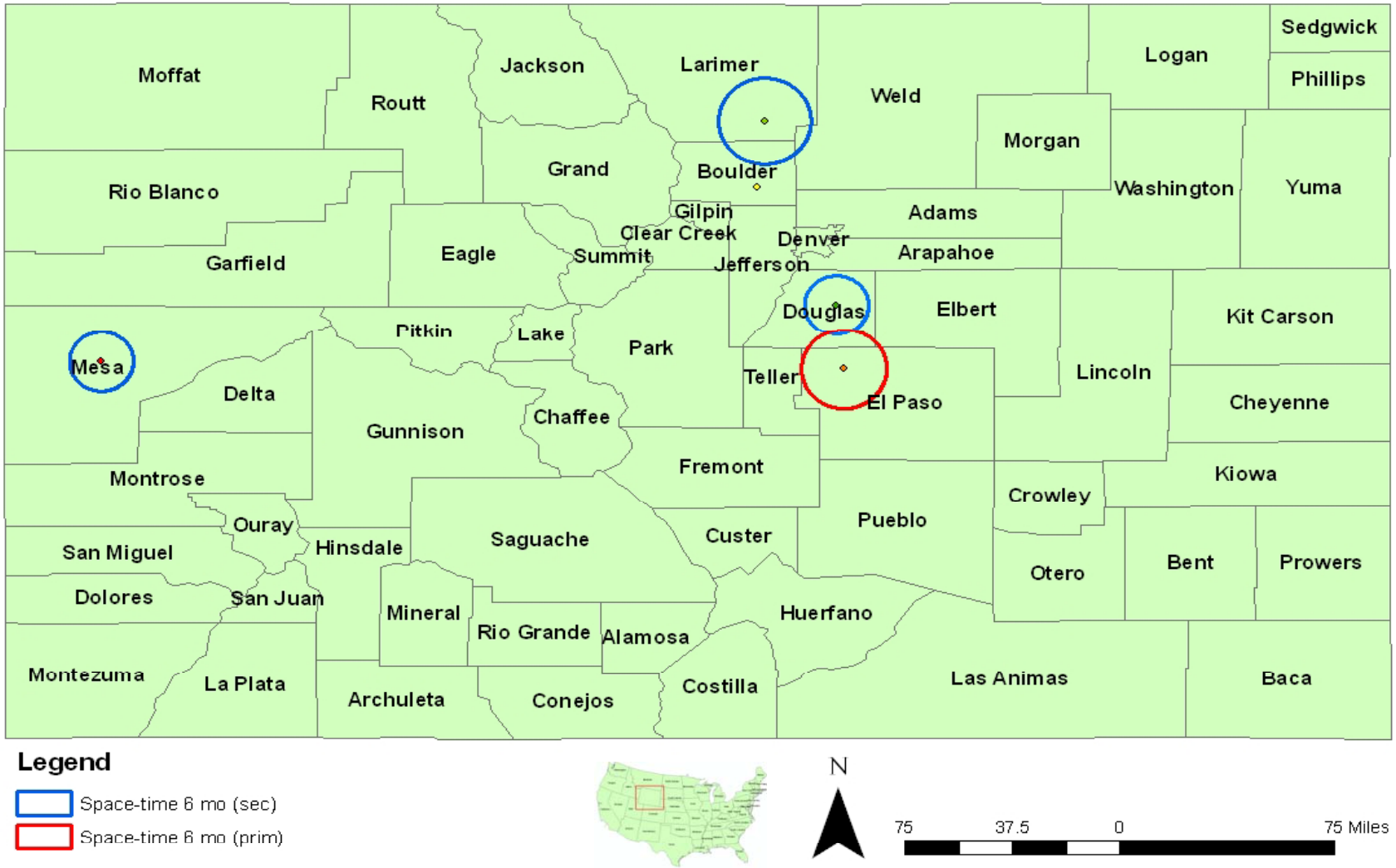
Giardia Prevalence by State



Giardia Prevalence by County in Colorado



Space-Time Cluster (6 mos) of Giardia in Colorado



Space-time Cluster Characteristics

Cluster	Time interval	Radius	Obs./Exp.	P-value
Primary	01/03 - 06/03	24 km	5.6	0.001
Secondary				
1	01/06 - 06/06	19 km	9.91	0.001
2	01/04 – 06/04	18 km	7.55	0.001
3	07/04 – 12/04	26 km	12.65	0.001

Discussion and conclusions

- Overall *Giardia* spp. prevalence (0.55%) in this study was lower than most previously reported estimates
- High prevalence of *Giardia* spp. infection in Colorado was not expected

- Dogs in Maine had highest prevalence (4.00%), but small samples size made this estimate unreliable
  - A high prevalence of *Giardia* spp. infection in dogs from NH has been reported

Discussion and conclusion

- **Significant space and space/time clusters of *Giardia* spp. infection observed in high prevalence state (CO)**
- **Clustering (non-random occurrence) suggests role for local environmental factors:**
  - ✓ **water sources (well, municipal)**
  - ✓ **water treatment (chlorination, filtration)**
  - ✓ **wildlife reservoirs (beavers)**
- **Dogs may be useful sentinel for *Giardia* spp. infection in humans and for deficiencies in water quality**
- **Dogs (unlike humans) undergo routine fecal examinations**
  - **More likely to reveal outbreaks than reportable disease surveillance?**

Future research

1. **Compare prevalence of infection and disease in dogs and humans living in same geographic area**

2. **Further examine risk factors that explain observed clustering:**
   - **Seasonality/climate**
   - **Water sources**
   - **Water treatment**

3. **Evaluate predictive value of dogs as sentinel for human infection (public health)**

Major Limitations

- **Did not identify species of *Giardia***
- **Probably underestimated *Giardia* spp. prevalence.**
  - **floatation method alone is less sensitive than centrifugation**

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Thank you

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